

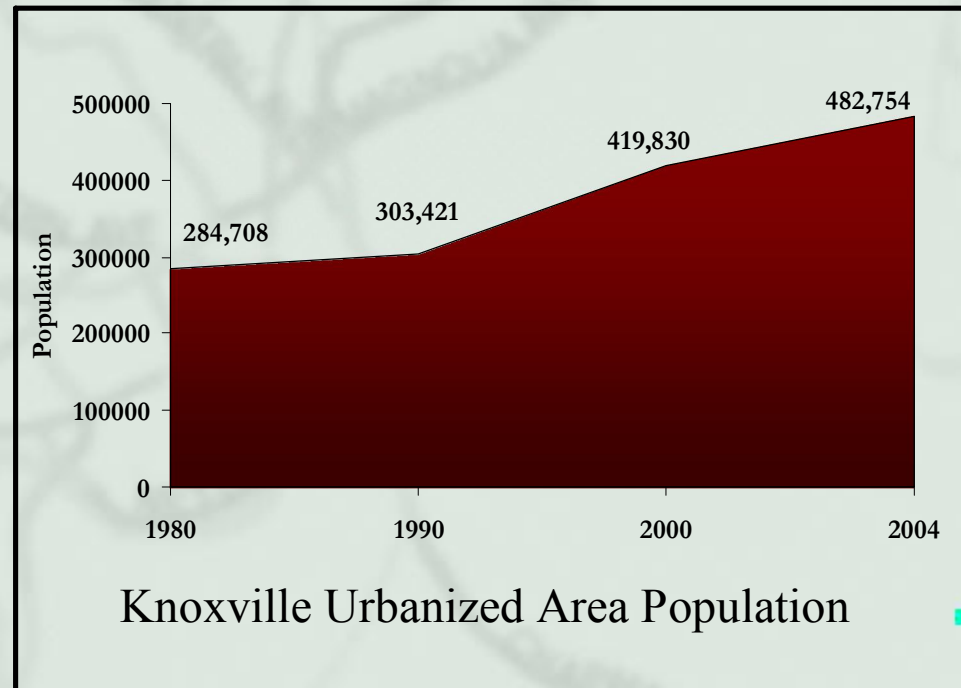
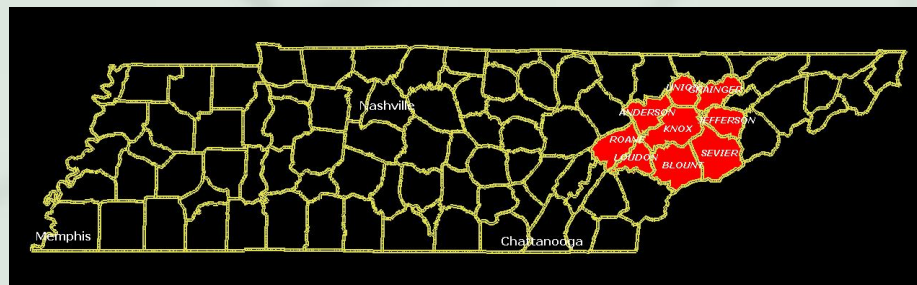
**Recent and Planned Improvements  
to the  
Knoxville Regional  
Travel Demand Forecasting Model**

**TMIP Web Seminar  
Travel Forecasting Modeling Activities at MPOs**

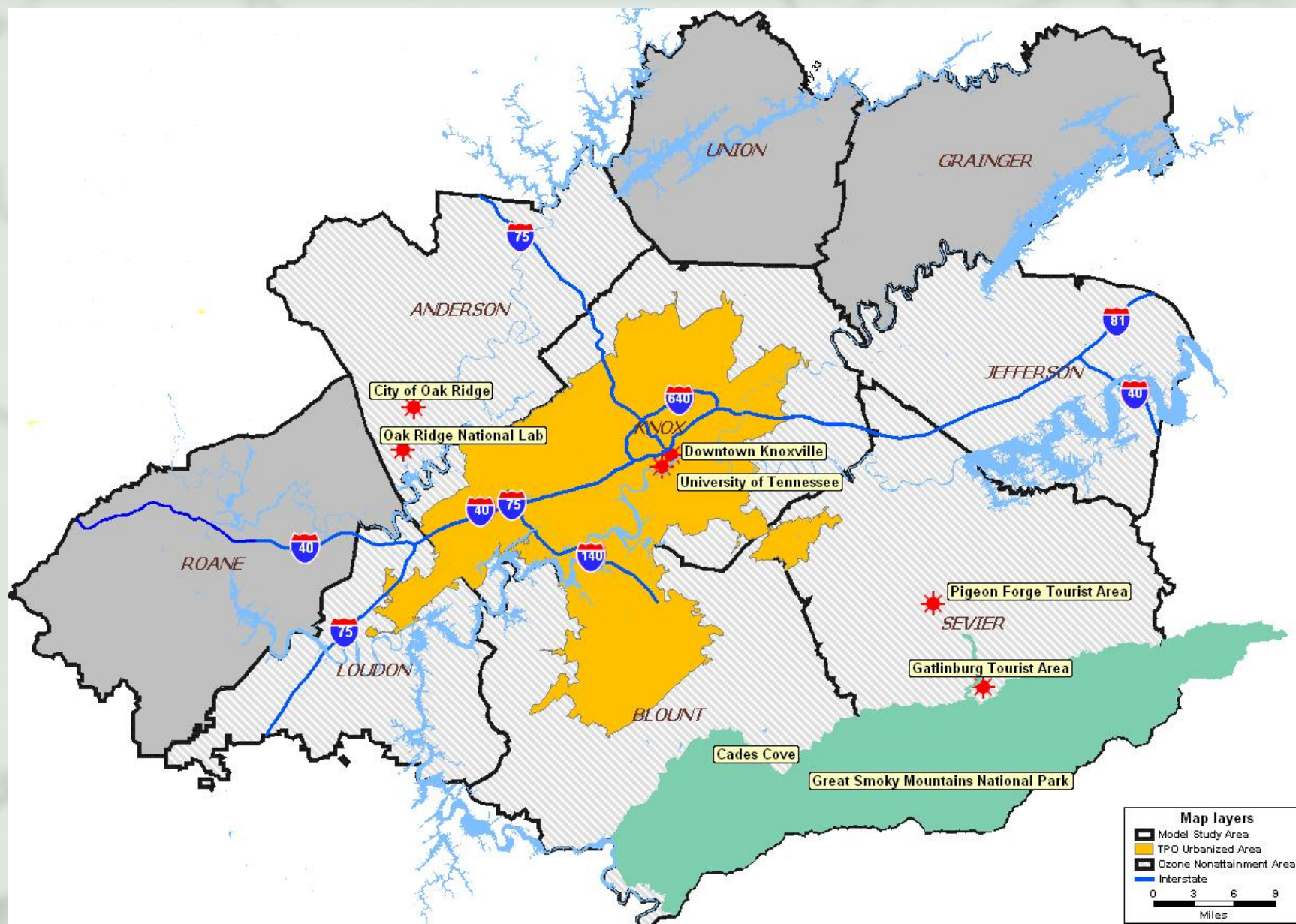
**November 28, 2007**

## TPO Overview: Study Area

- Knoxville urbanized area consists of Knox, Blount and portions of Loudon and Sevier counties
- Nonattainment for both ozone and PM2.5
- Nonattainment area adds Anderson, Jefferson and portions of Roane and Cocke counties



# Knoxville Regional Transportation Planning Organization



## **TPO Overview: Staffing Background**

- Housed within the Knoxville/Knox County Metropolitan Planning Commission (MPC)
- Director + 5 planners and 2 engineers
- No specific travel demand model “shop
- Share GIS, research and graphics staff with MPC



## **Travel Demand Model Overview: 10 Year Evolution 1998 - Present**

- 1998 – 3-step (no formal mode choice component) MINUTP model covering Knox & Blount counties (340 TAZs)
- 2001 – model converted to TransCAD software platform
- 2000/2001 – HH survey completed with 1500 HH's in Knox and Blount counties
- 2004 – model update based on HH survey completed. Expansion of roadway network to 10-county area and 717 TAZs
- 2007 – completion of scope of work for next model update

## **Travel Demand Model Overview: Process Used To Develop Model Update Scope**

- Fall 2005 – held a peer exchange
  - Facilitated by Jerry Everett with University of Tennessee CTR and included Guy Rousseau with ARC and Leta Huntsinger with ITRE along with previous consultant Vince Bernardin with BLA.
  - Identified prioritization of model update needs
  - Identified estimated cost ranges for improvements.
- Fall 2006 – issued an RFP for initial phase of model updates
- Winter 2006/2007 – awarded contract to Bernardin Lochmueller and Associates and split project into 2 separate contracts. First contract to conduct formal model review in order to refine scope of work for later phases of work.
- Spring 2007 – conducted “model scoping seminar” and consultant reviewed model performance against updated information available from sources such as traffic counts, CTPP and statewide travel demand model.
- Summer 2007 – issued an RFP for second phase of model updates

## Travel Demand Model Improvement Needs Identification

- Needs identified through recommendations from peer exchange review, formal model performance review and staff desired enhancements.
  - Sparse roadway network/large TAZs in area outside of core Knox and Blount counties.
  - Number of employment variables cumbersome to forecast
  - Lack of land use model
  - Lack of mode choice model
  - Single feedback loop of impedance to trip distribution.
  - Discrepancy between statewide model and regional model in terms of E-E trips.
  - Deteriorating validation statistics based on review of 2006 model run versus 2006 ground counts.
  - Discrepancy between CTPP flows and regional model HBW flows.
  - Desire to reduce or eliminate use of K-factors in gravity model.

## Travel Demand Model Improvement Needs Prioritization Process

- Among the model components that could be improved, IS IT FOUNDATIONAL??
  - Does it affect many trips and/or vehicle-miles of travel?
- Is there a pressing “hot button” issue that the improvement could shed light on?
- How effective is the proposed method at really improving the model’s performance?
  - Is there the risk that a lot of \$\$ could be spend with little to show for it?
- What’s it going to cost?



## Travel Demand Model Improvement Phasing Plan

- Phase I: “Quick turnaround” improvements by spring 2008
- Land use model phase: Complete by summer 2008
- Phase II: Update household survey and implement major model component improvements – complete by spring 2009

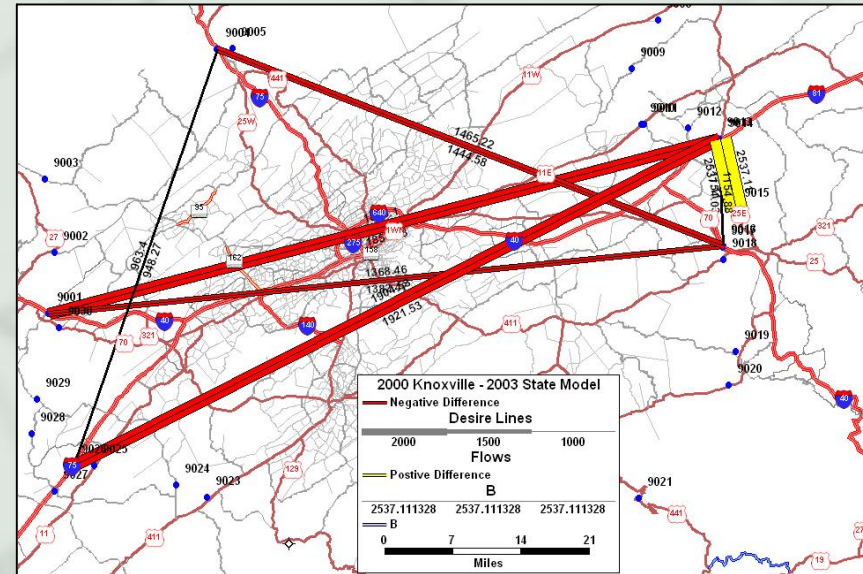
## Travel Demand Model Update Scope - Phase I

- Roadway network and TAZ enhancement in “regional” area
  - Completed in-house
  - Expanded from 717 TAZs to 865
- Simplify, adjust and validate existing trip generation model
  - Based on TPO staff desire to reduce some complexity involved with number of employment categories
  - Adjust HBW and NHBW gravity models to achieve closer agreement with CTPP flows
  - Insert new external trip tables based on an updated video camera external travel survey
  - Validate with 2006 ground counts
- Add a convergence based feedback loop from traffic assignment to trip distribution
  - Consultant will test both the method of successive averages (MSA) and fixed factor averaging (FFA) and the more efficient method will be implemented

# Knoxville Regional Transportation Planning Organization

## Travel Demand Model Update Scope Phase I – External Survey Detail

- Study conducted in September 2007 using video cameras located at 5 major interstate locations and 1 high volume arterial at cordon line.
- Need for study based on discrepancy between our model and statewide model for E-E flows.
- Video taped each lane in both directions at every station. Data “hand-coded” into database system.
- Cost effective and least intrusive method of capturing data. Quick implementation through TDOT on-call contract.



# Knoxville Regional Transportation Planning Organization

## Travel Demand Model Update Scope Land Use Model Phase

- Received grant from Tennessee DOT to develop a land use model known as the Urban Land Use Allocation Model (ULAM)
- Project began Oct. 1, 2007 and is expected to take 8 months to complete
- Takes county-level control totals and allocates them to TAZ-level based on several factors
- Allows for testing of land use alternatives





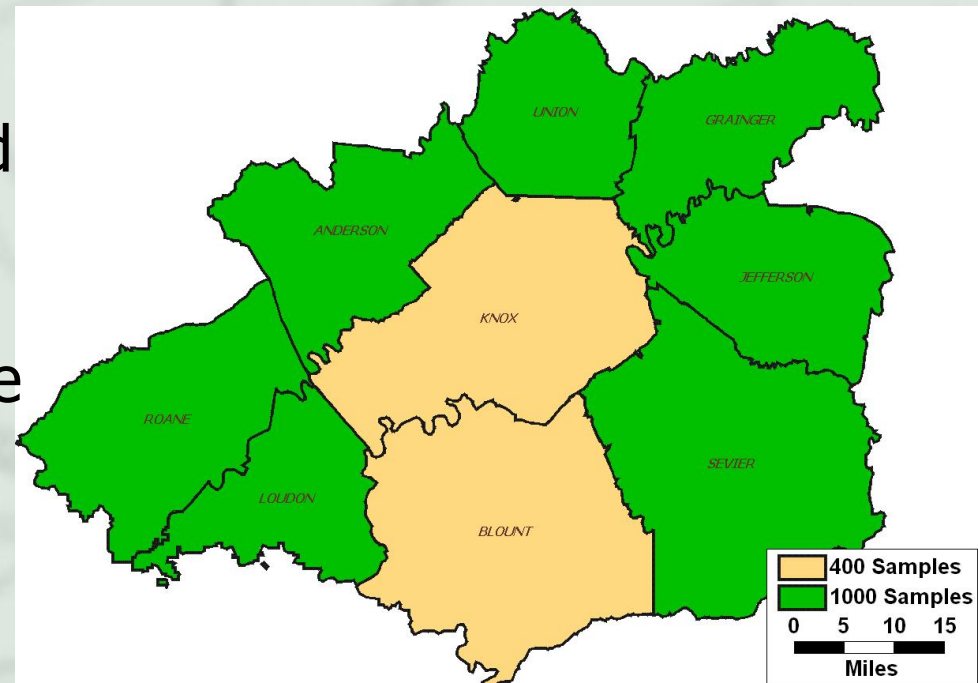
## Travel Demand Model Update Scope - Phase II

1. Data Collection
  - Update Household Travel Survey
2. Trip Generation Input Data
  - Demographic and Vehicle Ownership Models
  - Disaggregate Population Synthesizer
3. Trip Generation
  - Disaggregate Trip Production Generation Models
  - Time-of-Day Choice Model
4. Mode Choice
  - Pre-Distribution Mode Choice Model
5. Trip Distribution
  - Discrete Logit Destination Choice Models
6. Traffic Assignment
  - Vehicle Occupancy/HOV Assignment Model
  - Toll Choice/Assignment Model with HOT Capability
  - Two-Class Truck Model
  - MMA Trip Assignment



## 1. Data Collection - Household Travel Survey Update

- Purpose is to collect data in outlying areas not included in previous survey
- Sampling quotas established based on socioeconomic stratifications in order to minimize non-response issue for traditionally under represented households
- Will monitor geographic distribution as well to prevent over representation of any one county



## 2. Trip Generation Input Data

- Demographic and vehicle ownership models
  - Implement automated models that predict zonal totals and/or variable averages needed for trip generation that are not provided by ULAM
  - Generates zonal “control totals” as input to the next process...
- Disaggregate population synthesizer
  - Estimates detailed demographic characteristics of literally every household in the Knoxville region
  - Based on a combination of the new HH survey data and census data

## 3. Trip Generation

- Disaggregate trip production models
  - Use household-level regression models to generate trip productions rather than using 2 way cross-classified household trip rates
  - Allows for several additional variables to be used
  - Exploring use of accessibility and density variables to account for phenomena such as induced or suppressed trip making based on different land use policies, i.e. Mixed use
- Time-of-day choice model
  - Everything from this point forward in the model design is TOD specific
  - TOD modeling allows for:
    - The mode choice model to be sensitive to different headways
    - The destination choice model to be sensitive to different levels of congestion
    - HOV assignments will be sensitive to peak period lane restrictions
    - The toll choice model can become a congestion pricing tool

## 4. Mode Choice

- Pre-distribution mode choice model
  - Decision to do pre-distribution mode choice at this time in absence of a transit network and based on a largely “captive” transit market at this time
  - An on-board transit survey is planned by the transit agency in spring 2008
  - Hope to eventually develop a post-distribution mode choice model with next generation of model updates

## 5. Trip Distribution

- Discrete Logit destination choice models
  - Largely based on desire to eliminate the use of K-factors
  - Incorporates use of more variables to explain trip destinations than the gravity model

### Gravity

Employment  
Enrollment  
Households  
Travel Time  
K factors

### Destination Choice

Employment  
Enrollment  
Households  
Travel Time  
Travel Time Squared  
Distance  
Income of Traveler  
Accessibility of Home Zone  
Accessibility of Destination  
Estimable Bias factors



## 6. Traffic Assignment

- Vehicle occupancy/HOV assignment model
  - Post-distribution auto occupancy model
  - Enables SOV to be restricted from potential HOV lanes using the TransCAD MMA algorithm
- Toll choice/assignment model with HOT capability
  - Post-distribution logit choice model that estimates “toll eligible” trips which are assigned with MMA
- Two-class truck model
  - Plan to use method from quick response freight manual to predict trips for both “four-tire commercial vehicles” and “trucks”
- MMA trip assignment
  - Multi-class multimodal assignment necessary to model toll and HOV facilities

## Summary And Budget

- Model performance review and scoping seminar
  - Included scoping seminar (complete) \$18,000
- Data collection
  - External video camera survey (complete) \$115,000 (funded by TDOT)
  - Household travel survey \$230,000
- Phase I
  - Quick turnaround model improvements (underway) \$44,000
- Land use model
  - ULAM (underway) \$120,000 (funded through TDOT grant)
- Phase II
  - Model component development \$210,000

<p>Total = \$ 740,000</p> <p>TPO funds = \$ 500,000</p>
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